



(22) Date de dépôt/Filing Date: 2005/06/02

(41) Mise à la disp. pub./Open to Public Insp.: 2006/12/02

(51) Cl.Int./Int.Cl. *E21B 17/10* (2006.01)

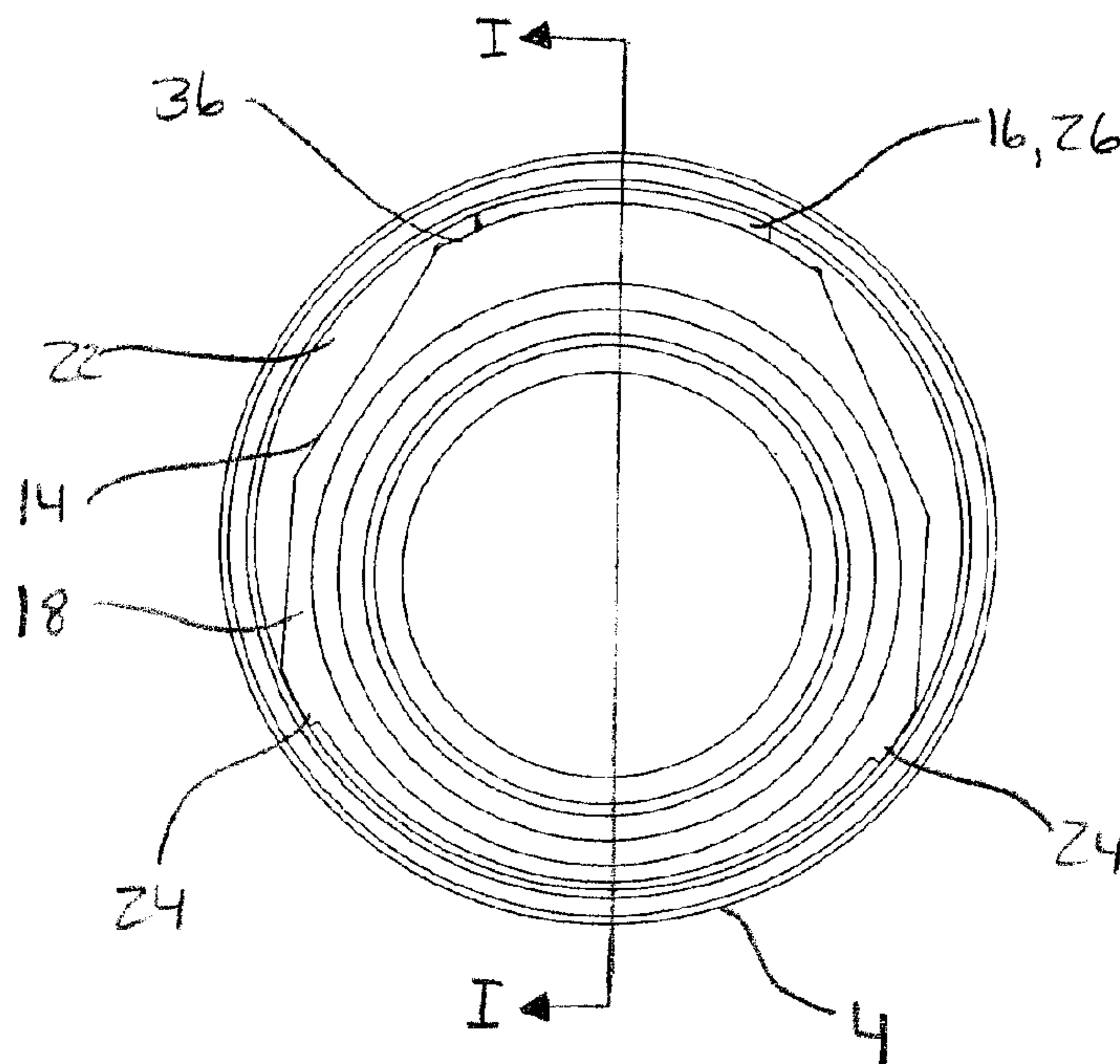
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(54) Titre : STABILISATEUR DE POMPE ROTATIVE

(54) Title: ROTARY PUMP STABILIZER



(57) **Abrégé/Abstract:**

A stabilizer is provided for stabilizing a rotary or progressive cavity pump suspended from production tubing in well casing. The stabilizer is connected between the production tubing and the pump. The stabilizer has a tubular body having a cylindrical wall and a longitudinal bore contiguous with the production tubing. A releasable sliding dog is disposed on the exterior of the tubular body and is operatively connected by a link to one or more pistons. Each piston is disposed in a piston housing that is in fluid communication with the bore of the tubular body. Circumferentially spaced-apart feet extend radially outwardly from the tubular body. In operation, actuating fluid pressure advances the pistons uphole, driving the sliding dog up one or more longitudinal outwardly extending ramps to brace against the casing, with the feet contacting the casing and bearing opposing reactive force. Preferably, the sliding dog and the feet form a three-point contact with the casing that arrests lateral movement in any direction. Under non-actuating pressure, upward drag on the sliding dog compresses the pistons, retracting the dog, and permitting removal of the stabilizer and pump.

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ABSTRACT OF THE DISCLOSURE

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A stabilizer is provided for stabilizing a rotary or progressive cavity pump suspended from production tubing in well casing. The stabilizer is connected between the production tubing and the pump. The stabilizer has a tubular body having a cylindrical wall and a longitudinal bore contiguous with the production tubing. A releasable sliding dog is disposed on the exterior of the tubular body and is operatively connected by a link to one or more pistons. Each piston is disposed in a piston housing that is in fluid communication with the bore of the tubular body. Circumferentially spaced-apart feet extend radially outwardly from the tubular body. In operation, actuating fluid pressure advances the pistons uphole, driving the sliding dog up one or more longitudinal outwardly extending ramps to brace against the casing, with the feet contacting the casing and bearing opposing reactive force. Preferably, the sliding dog and the feet form a three-point contact with the casing that arrests lateral movement in any direction. Under non-actuating pressure, upward drag on the sliding dog compresses the pistons, retracting the dog, and permitting removal of the stabilizer and pump.

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## **"ROTARY PUMP STABILIZER"**

### **FIELD OF THE INVENTION**

The invention relates to a dynamic pressure-responsive apparatus used for the stabilization of tools suspended from production tubing, said tools being subject to undesirable lateral movement, and particularly tools subject to vibration in operation such as progressive cavity pumps.

### **BACKGROUND OF THE INVENTION**

Apparatus are known for stabilizing various well tools which are suspended at the bottom of a production tubing string. An example of a tool which would benefit from stabilization is a rotary or progressive cavity pump ("PC pump"). A PC pump is located within an oil well, positioned at the bottom end of a production tubing string which extends down the casing of the well. The pump pressurizes well fluids and drives them up the bore of the production tubing string to the surface. The pump comprises a pump stator coupled to the production tubing string, and a rotor which is both suspended and rotationally driven by a sucker rod string extending through the production tubing string bore. The stator is held from reactive rotation by a tool anchored against the casing. Usually this anti-rotation tool or torque anchor is located at the base of the stator and typically applies serrated slips to grip against the casing.

The rotor is a helical element which rotates within a corresponding helical passage in the stator. Characteristically, the rotor does not rotate concentrically within the stator but instead scribes a circular or elliptical path.

1 This causes vibration and oscillation of the sucker rod, the pump's stator and the  
2 tubing attached thereto.

3 The greater the pump flow, the greater is the vibration. This can  
4 lead to loosening of the slips and functional failure of the no-turn tool. Other  
5 problems include fatigue failure of the connection of the stator to the tubing or  
6 nearby tubing-to-tubing connections.

7 In the prior art, bow springs have typically been used to centralize  
8 and stabilize the stator and the supporting tubing. By design, the bow springs  
9 are radially flexible, in part to permit installation and removal through casing.  
10 Unfortunately, the spring's flexibility permits cyclic movement, resulting in fatigue  
11 and eventual failure of the springs.

12 Unitary tubing string centralizers generally position the tool in a  
13 concentric or central position in the well. While these centralizers may provide a  
14 positioning function, they are not effective as a tool-stabilizing means. The  
15 known centralizers are passive devices and do not actively contact the casing.

16 More sophisticated apparatus are known which more positively  
17 secure and position tools within a well. For example, in U.S. Patent 2,490,350 to  
18 Grable, a centralizer is provided using mechanical linkages which lock radially  
19 outwardly to engage the casing. Each of a plurality of two-bar linkages is held  
20 tight to the outside of the tubing string with a retaining bolt. A longitudinal spring  
21 and longitudinal ratchet are arranged external to the tubing for pre-loading of one  
22 link with the potential to jack-knife the linkage outwardly, except for the  
23 restraining action of the retaining bolt. A radial plunger extends through the  
24 tubing wall to contact the linkage. The plunger has limited stroke. When the  
25 tubing string bore is pressurized, the plunger urges the linkage sufficiently

1 outwardly to break the retaining bolt, permitting the spring to drive the linkage  
2 radially outwardly. The driven link engages the ratchet, ensuring the linkage  
3 movement is uni-directional.

4           In U.S. Patent 4,960,173 to Cognevich, a tubular housing is also  
5 disclosed having mechanical linkages which are held tight to the housing during  
6 installation. The linkages are irreversibly deployed upon melting of a fusible link  
7 at downhole conditions. An annular compression spring actuates a telescoping  
8 sleeve which deploys a four-bar linkage and forcibly holds the linkage against  
9 the casing wall. Rollers on the ends of two of the linkages contact the casing  
10 wall for aiding in limited longitudinal movement of the tubular housing once the  
11 linkages are deployed. Gradual radial adjustment of the linkage is permitted by  
12 a fluid bleed to permit the telescoping sleeve to slowly retract during this  
13 movement. If the bleed fails and additional radial movement continues, a pin will  
14 shear, fully releasing the telescoping sleeve and linkage from the compression  
15 spring.

16           In summary, both Grable and Cognevitch disclose apparatus  
17 which: rely upon compression spring force alone to drive and hold the linkages  
18 radially outwardly; do not deploy or extend the linkage until after installation on  
19 the casing; result in an irreversible deployment; and in the case of Grable, do not  
20 permit movement or removal without damage to the linkage, and in the case of  
21 Cognevitch, limited movement is permitted but if the linkage cannot accept the  
22 movement required, a jarring action will shear a pin and irreversibly separate the  
23 compression spring from the linkage.

24           In Canadian Patent Application 2,296,867 to Tessier, a tubular  
25 stabilizing apparatus is disclosed having a sliding dog disposed in a longitudinal

1 pocket formed in the exterior of the tubular body. The sliding dog is activated by  
2 pistons pivotally connected to the sliding dog whereby fluid pressure within the  
3 piston bore dynamically drives the pistons to move the sliding dog along a ramp  
4 formed within the pocket. The tip of the sliding dog is thereby driven upwardly  
5 and outwardly to contact and brace against the casing, with the opposite side of  
6 the tubular body contacting the casing.

7           While the stabilizing apparatus of Tessier provides several  
8 advantages over the prior art, under some circumstances, the two-point contact  
9 of the tip of the sliding dog and the opposing tubular body with the casing may  
10 not provide sufficient stabilization against movement transverse to the plane of  
11 contact.

12           There is, therefore, a need for an improved stabilizing apparatus.

1

SUMMARY OF THE INVENTION

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A stabilizer is provided for securely and releasably stabilizing downhole tools suspended from a production tubing string containing fluid under varying pressure. Such a tool is associated with or is the source of lateral movement within the casing.

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In a broad aspect of the invention, the stabilizer is positioned between a well tool, such as a PC pump, and the production tubing string. The stabilizer comprises a tubular body having a cylindrical wall and a longitudinal bore contiguous with that of the production tubing string. A releasable stabilizing means or assembly is disposed on the exterior of the tubular body that extends radially outward to contact the casing when actuated. At least two circumferentially spaced-apart feet extend radially outward from the tubular body to contact the casing when the stabilizer is actuated. More particularly, the angle between the stabilizer and the feet adjacent to the stabilizing means is greater than ninety degrees, preferably in the range of about 110 degrees to about 160 degrees, and most preferably about 120 degrees, such that the feet bear reactive force against the stabilizing means to substantially arrest lateral movement in any direction. Preferably, there are two feet equidistant from the stabilizing means and at an angle of about 120 degrees forming a three-point contact of the feet and the stabilizer with the casing.

21

In one embodiment, the stabilizer utilizes fluid pressure to actively and forcefully stabilize the tool against lateral movement in any direction. Further, when the fluid pressure diminishes, such as when no fluid is being produced, the apparatus may be readily repositioned, repeatedly installed or removed without irreversible alteration of the apparatus or peripheral damage.

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1 The apparatus is dynamically responsive so as to provide greater stabilizing  
2 force at higher fluid pressures, for instance, in the case of a PC pump tool, when  
3 the pump is pumping more vigorously.

4 Preferably, the stabilizing means comprises a radially outwardly  
5 extendable sliding dog operably connected to a fluid pressure-driven actuating  
6 means or actuator comprising one or more pistons, housed and moveable within  
7 piston bores formed in a piston housing. The piston bore is in communication  
8 with the bore of the tubular body so that it is pressurized dynamically with fluid.  
9 Fluid pressure causes the pistons to advance uphole, driving the sliding dog  
10 upward to be driven up at least one ramp, so as to move radially outwardly to  
11 contact and brace against the casing, with the radial force being proportional  
12 with the fluid pressure. Preferably, there are two longitudinally spaced-apart  
13 ramps and the sliding dog and the pistons are connected by a pivotable link such  
14 that the sliding dog is substantially parallel with the casing when actuated.

15 The stabilizer can also include a shear pin extending through the  
16 wall of the tubular body and the stabilizing means to prevent pre-actuation of the  
17 stabilizer, such as when the stabilizer is being installed within the well. Further,  
18 stops can be provided that limit longitudinal movement of the stabilizing means  
19 or actuating means to obviate a possible jamming of the stabilizer in the well.

1                                    BRIEF DESCRIPTION OF THE DRAWINGS

2                                    In drawings which are intended to illustrate embodiments of the  
3 invention and which are not intended to limit the scope of the invention:

4                                    Figure 1 is a cross-sectional view of the lower end of a well casing  
5 with the stator of a PC pump located therein, the pump having an embodiment of  
6 the stabilizer of the present invention connected thereabove for stabilizing the  
7 pump and tubing within the casing, and with the cross-section of the stabilizer  
8 taken along line I-I of Fig. 3B;

9                                    Figure 2 is a partially exploded perspective view the stabilizer  
10 according to Fig. 1;

11                                    Figure 3A and 3B are top end views of the stabilizer taken along  
12 the lines III-III of Figs. 4A and 4B, respectively, with the stabilizer installed in a  
13 well casing and shown in the non-actuated condition (Fig 3A) and actuated  
14 condition (Fig. 3B);

15                                    Figures 4A and 4B are elevational views of the stabilizer according  
16 to Fig. 1, with part of the piston housing cut away and shown in the non-actuated  
17 condition (Fig. 4A) and actuated condition (Fig. 4B); and

18                                    Figures 5A and 5B are cross-sectional views taken along lines V-V  
19 of Figs. 4A and 4B, respectively, with the stabilizer installed in a well casing.

20                                    Figure 6 is a cross-sectional view of an alternative embodiment of  
21 a stabilizer according to the present invention with the stabilizer installed in a  
22 well casing and in the actuated condition.

1           DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

2           Having reference to Fig. 1, one embodiment of a stabilizer 2 is  
3 located within the bore 3 of the casing 4 of a completed oil well 6. The stabilizer  
4 2 is suspended from a production tubing string 7 and connected to a downhole  
5 well tool such as a rotary pump. Shown in this embodiment, the stabilizer 2 is  
6 connected co-axially via a pup joint 8 to the stator 10 of a progressive cavity  
7 pump ("PC pump") 12 located within the well casing 4. The PC pump 12 is  
8 therefore suspended from the production tubing string 7 by connection through  
9 the stabilizer 2. In operation, the PC pump 12 pressurizes well fluids and directs  
10 them up the bore 13 of the production tubing string 7 to the surface.

11           In the context of a PC pump 12, its stator 10 is secured against  
12 reactive torque rotation in the casing 4. While not shown, it is understood that  
13 the stator 10 is secured using an anti-rotation tool or a torque anchor usually  
14 positioned at the lower end of the PC pump 12. The rotor of the PC pump 12,  
15 which is not shown for clarity of the other components, would be typically  
16 suspended and rotationally driven from a sucker rod, also not shown.

17           Referring also to Figs. 2, 3A and 3B, the stabilizer 2 comprises a  
18 tubular body 14 and a releasable stabilizing means or assembly 16 disposed on  
19 the exterior 17 of the tubular body 14. The tubular body 14 has a contiguous  
20 annular wall 18 forming a longitudinal bore 20 extending therethrough for  
21 passing pressurized well fluids pumped from the PC pump 12, through the  
22 tubular body bore 20 and up the production tubing string bore 13 to the surface.  
23 An annular space 22 is formed between the tubular body 14 and the casing 4.

24           The releasable stabilizing means 16 is radially outwardly extendible  
25 to engage the casing 4. Actuation such as by fluid pressure in the tubular body

1 bore 20 (PB), which is greater than the pressure in the annulus 22 (PA), forcibly  
2 actuates and braces the stabilizing means 16 against the casing 4 and thereby  
3 jams the tubular body 14 against the opposing side of the well casing 4 to  
4 substantially arrest oscillatory movement of the PC pump stator 10. The  
5 stabilizing means 16 is dynamically actuated by fluid pressure which makes the  
6 stabilizing capability stronger as the fluid pressure PB increases.

7           In greater detail, the tubular body 14 is profiled to provide at least  
8 two longitudinally extending and circumferentially spaced-apart protrusions or  
9 feet 24. The effective diameter of the stabilizer 2 before actuation is less than  
10 the diameter of the casing bore 3 to permit installation of the stabilizer 2 therein.  
11 The angle A between the stabilizing means 16 and each of the feet 24 adjacent  
12 to the stabilizing means 16 is greater than 90 degrees, preferably in the range of  
13 about 110 degrees to about 160 degrees, such that when the stabilizing means  
14 16 is actuated, the stabilizing means 16 and the feet 24 contact the casing. In  
15 other words, each of the feet 24 need to bear opposing reactive force against the  
16 stabilizing means 16 when actuated. Preferably, there are two feet 24  
17 equidistant from the stabilizing means 16 and the angle is about 120 degrees,  
18 thereby forming a three point contact of the stabilizing means 16 and the feet 24  
19 with the casing 4 to substantially arrest lateral movement of the PC pump 10 in  
20 any direction.

21           It is to be noted that while Fig. 3A shows the feet 24 contacting the  
22 casing 4 in the non-actuated position, this is only to more clearly show the radial  
23 movement of the stabilizing means 16 within the annular space 22 upon  
24 actuation. In fact, the stabilizer 2 is loosely and randomly fit within the casing  
25 bore 3 until it is actuated.

1           The stabilizing means 16 comprises a sliding dog 26 and a fluid  
2 pressure-driven actuating means or actuator 28. Having further reference to  
3 Figs. 4A, 4B, 5A and 5B, the sliding dog 26 is operable between a retracted  
4 position (Figs. 4A, 5A) and a radially outwardly extended position (Figs. 4B, 5B)  
5 for engagement of the sliding dog 26 with the casing 4.

6           The sliding dog 26 and actuating means 28 are positioned in a  
7 longitudinally extending pocket 34 formed in a thickened portion 36 of the  
8 annular wall 18. The pocket 34 extends radially inwardly or is recessed from an  
9 outer surface 38 of the tubular body 14. More particularly and as best seen in  
10 Fig. 2, the pocket 34 has an uphole portion 44 into which the sliding dog 26 is  
11 disposed and a downhole portion 46 into which the actuating means 28 is  
12 disposed. The sliding dog 26 and actuating means 28 are operatively connected  
13 by one or more links 48 positioned therebetween and pivotally attached thereto  
14 with pins 49, such as a roll pins. Each link 48 is a double link having first and  
15 second ends 48a, 48b to enable both axial and radial displacement of the sliding  
16 dog 26.

17           The uphole portion 44 includes a first, uphole ramp 50 and a  
18 parallel second, downhole ramp 52 longitudinally spaced by a land 54 from the  
19 first ramp 50. The ramps 50, 52 extend longitudinally and outwardly from the  
20 floor 56 of the pocket 34. In operation, as shown in Figs. 4B and 5B, when the  
21 tubular body bore 20 is pressurized for actuation ( $P_B \gg P_A$ ), the actuating means  
22 28 is advanced longitudinally uphole for driving the sliding dog 26 against the  
23 first and second ramps 50, 52. The ramps 50, 52 deflect the sliding dog 26  
24 radially outward, similar to the action of a parallelogram linkage, as the links 48  
25 pivot relative to the actuating means 28 and the sliding dog 26. Eventually, as

1 the actuating means 28 advances, the sliding dog 26 radially contacts and  
2 braces against the casing 4, with the sliding dog 26 being substantially parallel to  
3 the casing 4.

4 To prevent the sliding dog 26 from falling out of the pocket 34  
5 during handling outside of the casing 4, while also subsequently permitting  
6 movement of the sliding dog 26 as required, a shoulder screw 40 is affixed to the  
7 tubular body 14 and set within a longitudinally elongated screw hole 42.

8 In an alternative embodiment, as shown in Fig. 6, there is a single  
9 ramp 53. Further, the sliding dog 26 can be pivotally connected to the actuating  
10 means 28 by a hinge 57, in which case the sliding dog will pivot outwardly for  
11 contact of a tip 59 of the sliding dog 26 with the casing 4. Such an apparatus is  
12 described in Canadian Patent Application No. 2,292,867 to Tessier.

13 The actuating means 28 is an arrangement of one or more  
14 longitudinally-extending pistons 60 and piston bores 62, and ports 64 extending  
15 between each piston bore 62 and the bore 20 of the tubular body 14.

16 In detail, each piston bore 62 is drilled in a piston housing 66 that is  
17 fit within the downhole portion 46 of the pocket 34. The piston housing 66 is  
18 secured to the tubular body 14 by screws 68 or other suitable means. Each  
19 piston bore 62 has a first, uphole end 70 that opens into the pocket's uphole  
20 portion 44 and a second, downhole end 72 that communicates with the tubular  
21 body bore 20 through the ports 64. The ports 64 are drilled through the piston  
22 housing 66 and the annular wall 18 to form a contiguous port 64 when the  
23 housing 66 is fit within the pocket 34. An O-ring 74 is fit between the piston  
24 housing 66 and the annular wall 18 to form a fluid seal through the ports 64.

1                   A piston 60 is disposed in each piston bore 62 and is longitudinally  
2 movable between the bore's first and second ends 70, 72. Each piston 60 has  
3 an uphole, pocket end 76 and a downhole, pressure end 78. A double O-ring  
4 seal 80 is fit to the downhole end 78 of each piston 60 to prevent pressurizing  
5 fluid from flowing out of the piston bore 62, thereby forming a pressure chamber  
6 82 at the second end 72 of the piston bore 62. The uphole end 76 of each piston  
7 60 is pivotally connected to the first end 48a the link 48, with the second end 48b  
8 of the link 48 being pivotally connected to a downhole end 84 of the sliding dog  
9 26.

10                   When fluid pressure PB within the tubular body bore 20 is raised  
11 above the pressure PA outside the stabilizer 2, such as when a PC pump  
12 operates, the differential pressure (PB-PA) causes each piston 60 to advance in  
13 the uphole direction, actuating the sliding dog 26.

14                   The greater is the fluid pressure PB in the bore 20, the greater is  
15 the differential pressure (PB-PA), the greater is the force applied to each piston  
16 60 and the greater is the force applied by the sliding dog 26 against the casing 4.  
17 Serendipitously, as the downhole tool, such as a PC pump, works harder and  
18 results in greater vibration, the bore pressure PB also increases and the sliding  
19 dog 26 provides even greater stabilizing force. At the same time, an extension  
20 stop 86 is positioned to contact the uphole end 76 of each piston 60 to limit the  
21 piston 60 from over-stroking and thereby obviating a possible jamming of the  
22 stabilizer 2 in the casing 4.

23                   In an example case where each of two pistons 60 and piston bores  
24 62 are 3/4 inch in diameter, differential fluid pressures (PB-PA) of 2000 psi(g)

1 result in actuating forces of 1770 pounds, and radial forces of 8850 pounds  
2 being applied against the casing wall.

3 As best seen in Figs. 2, 4A and 4B, a shear pin 88 extending  
4 through at least one of the pins 49 and the annular wall 18 prevents premature  
5 actuation of the stabilizer 2 as it is inserted into the casing 4. The shear pin 88 is  
6 constructed of material that is capable of supporting sufficient load to prevent  
7 premature actuation, but which will shear at actuating forces, as shown in Figs.  
8 4A and 4B. In the above example case, the shear pin 88 can be a nylon shear  
9 pin capable of supporting a load of 400 lbs.

10 When it is necessary to move or remove the downhole tool or  
11 stabilizer 2 from the casing 4, the pressure is reduced in the tubular body bore  
12 20. In the case of a PC pump, pumping is stopped and the pressure differential  
13 between the tubular body bore 20 and the annulus 22 falls to reach equilibrium  
14 (PB substantially equals PA). The actuating means 28 goes slack and the force  
15 of the sliding dog 26 against the casing 4 drops, releasing the dog 26 and  
16 enabling movement of the stabilizer 2. Further, when the stabilizer 2 is being  
17 removed from the casing 4, upward movement drags the dog 26 against the  
18 casing 4 also forces the dog 26 back into the pocket 34 and the pistons 60 back  
19 in their bores 62.

20 To ensure a snag-free profile or line for ease of removal, uphole  
21 and downhole retraction stops 90, 92 are provided that limit the downhole  
22 movement of the sliding dog 26, as particularly seen in Figs. 2, 4A and 4B. The  
23 uphole retraction stop 90 is formed by the uphole end 94 of the land 54 between  
24 first and second ramps 50, 52. The uphole retraction stop 90 has an upwardly  
25 facing radial surface 96 extending to the pocket floor 56 that contacts a

1 downwardly facing radial surface 98 of the sliding dog 26. The downhole  
 2 retraction stop 92 projects outwardly from the pocket floor 56 and is positioned to  
 3 contact the downhole end 84 of the sliding dog 26. Conveniently, the downhole  
 4 stop 92 can correspond to the extension stop 86.

5 Preferably the tubular body 14 is cast or machined in one piece.  
 6 The pocket 34 is recessed into wall 18, such as being cast in place or formed  
 7 through a process such as milling. The following are examples of materials  
 8 suitable for use for the various stabilizer components.

9

Component	material
Tubular body 14	Carbon steel
Piston housing 66	302 stainless steel
Sliding dog 26	HTSR
Piston 60	17-4 stainless PH, grade HL50
Links 48	HTSR
Pins 49	stainless steel
O-rings 74, 80	Viton 90

10

1                   **THE EMBODIMENTS OF THE INVENTION IN WHICH AN**  
2 **EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS**  
3 **FOLLOWS:**  
4

5                   1. A stabilizer for stabilizing a well tool within a subterranean  
6 casing, the well tool being suspended from a production tubing and having a  
7 longitudinal bore for containing pressurized well fluid therein, the stabilizer  
8 comprising:

9                   a tubular body having a cylindrical wall and a longitudinal bore  
10 extending therethrough, the tubular body positioned within the casing between  
11 the well tool and the production tubing, the bore of the tubular body in  
12 communication with the bore of the production tubing;

13                  a releasable stabilizing means disposed on the tubular body, the  
14 stabilizing means being actuated to extend radially outward for contacting the  
15 casing; and

16                  at least two circumferentially spaced-apart feet extending radially  
17 outward from the tubular body, an angle between the stabilizing means and each  
18 of the feet adjacent to the stabilizing means being greater than 90 degrees,  
19 wherein the feet and the stabilizing means contacting the casing when the  
20 stabilizing means is actuated.

21  
22                  2.       The stabilizer of claim 1 wherein the angle is in the range of  
23 about 110 degrees to 160 degrees.

24  
25                  3.       The stabilizer of claim 1 wherein the angle is about 120  
26 degrees.

1

2           4.     The stabilizer of claim 1 wherein there are two feet  
3 equidistant from the stabilizing means, wherein the angle is about 120 degrees,  
4 and wherein the feet and the stabilizing means form a three-point contact with  
5 the casing when the stabilizing means is actuated.

6

7           5.     The stabilizing means of any one of claims 1 to 4 wherein  
8 the stabilizing means is actuated by fluid pressure in the bore of the tubular  
9 body.

10

1                   6.     The stabilizer of any one of claim 5 wherein the stabilizing  
2 means comprises:

3                   a recessed pocket formed in the wall, the pocket having an uphole  
4 portion and a downhole portion, the uphole portion forming at least one radially  
5 outwardly extending ramp;

6                   a radially outwardly extendable sliding dog disposed within the  
7 uphole portion of the pocket, the sliding dog having a first position and a second  
8 position, the sliding dog being retracted within the pocket in the first position and  
9 radially outwardly extended in the second position; and

10                  actuating means positioned within the downhole portion of the  
11 pocket and operatively connected to the sliding dog, the actuating means in fluid  
12 communication with the bore of the tubular body whereby the fluid pressure  
13 causes the actuating means to advance uphole, driving the sliding dog  
14 longitudinally along the at least one ramp to move the sliding dog from the first  
15 position to the second position to contact the casing and stabilize the well tool,  
16 the force of contact being substantially proportional to the fluid pressure.

17

18                  7.     The stabilizer of claim 6 wherein the actuating means is  
19 connected to the sliding dog by a link, and wherein the sliding dog is  
20 substantially parallel with the casing when actuated.

21

22                  8.     The stabilizer of claims 6 or 7 wherein the uphole portion of  
23 the pocket forms two longitudinally spaced and parallel ramps.

24

1           9.     The stabilizer of claim 8 further comprising an uphole  
2 retraction stop between the two ramps, the uphole retraction stop having an  
3 upwardly facing surface for contacting a downwardly facing surface of the sliding  
4 dog when in the first position.

5

6           10.    The stabilizer of any one of claims 6 to 9 further comprising:  
7           a downhole retraction stop positioned between the sliding dog and  
8 the actuating means, the downhole retraction stop limiting the downhole  
9 movement of the sliding dog.

10

11           11.    The stabilizer of any one of claims 6 to 10 further  
12 comprising:

13           an extension stop positioned between the sliding dog and the  
14 actuating means, the extension stop limiting the uphole movement of the  
15 actuating means.

16

17           12.    The stabilizer of claim 6 further comprising:

18           a downhole retraction stop positioned between the sliding dog and  
19 the actuating means, the downhole retraction stop limiting the downhole  
20 movement of the sliding dog; and

21           an extension stop positioned between the sliding dog and the  
22 actuating means, the extension stop limiting the uphole movement of the  
23 actuating means, wherein the downhole retraction stop and the extension stop  
24 are the same.

25

1                   13. The stabilizer of any one of claims 6 to 12 wherein the  
2 actuating means comprises:

3                   one or more piston bores formed in a piston housing, the piston  
4 housing securely fit within the downhole portion of the pocket, each piston bore  
5 having a first downhole end in communication with the bore of the tubular body  
6 and a second end open to the one or more pockets; and

7                   a piston longitudinally moveable within each piston bore and  
8 having an uphole end operatively connected to the sliding dog, the fluid pressure  
9 within the bore of the tubular body pressurizing each piston bore causing each  
10 piston to advance uphole to drive the sliding dog.

11

12                   14. The stabilizer of claim 13 wherein there are two piston  
13 bores, wherein the pistons are connected to the sliding dog by a link having a  
14 first end pivotally connected to the piston and a second end pivotally connected  
15 to the sliding dog, and wherein the uphole portion forms two longitudinally  
16 spaced and parallel ramps.

17

18                   15. The stabilizer of any one of claims 1 to 14 further comprising  
19 a shear pin extending through the wall and the stabilizing means to prevent  
20 actuation of the apparatus in the absence of actuating fluid pressure.

21

22                   16. The stabilizer of any one of claims 1 to 15 wherein the well  
23 tool being stabilized is a fluid pump that pressurizes fluid within the bore of the  
24 tubular body.

25

1                    17.    The stabilizer of claim 16 wherein the pump is a rotary  
2 pump.

3

4                    18.    The stabilizer of claim 16 wherein the pump is a progressive  
5 cavity pump.

FIG. 1

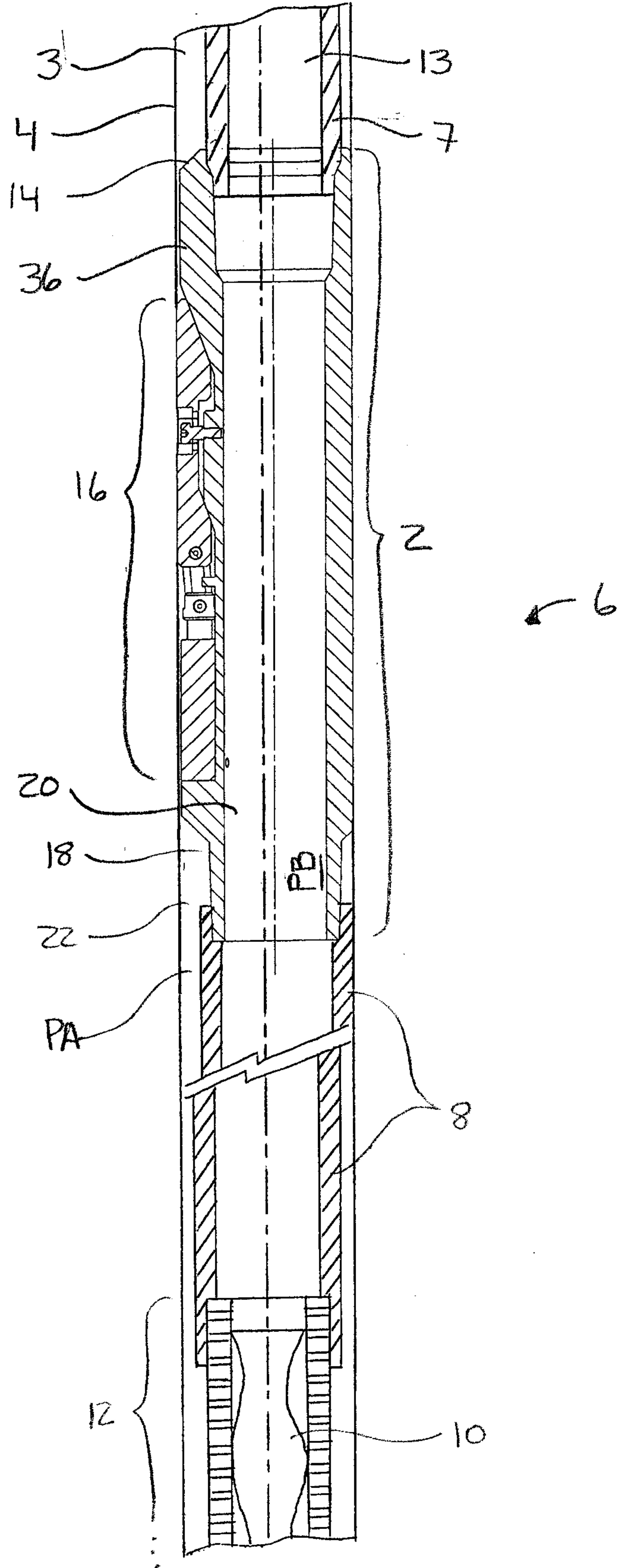
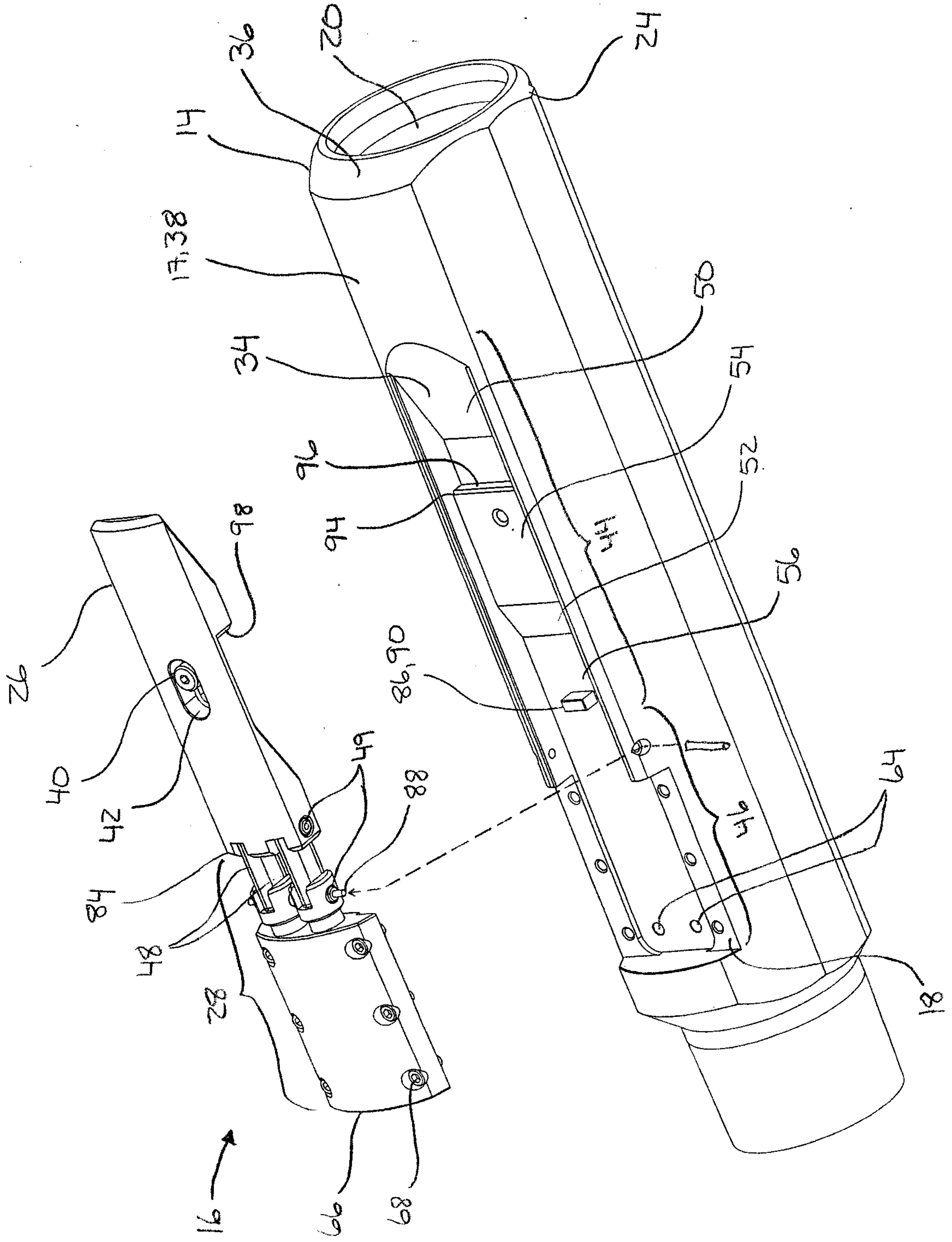


FIG. 2



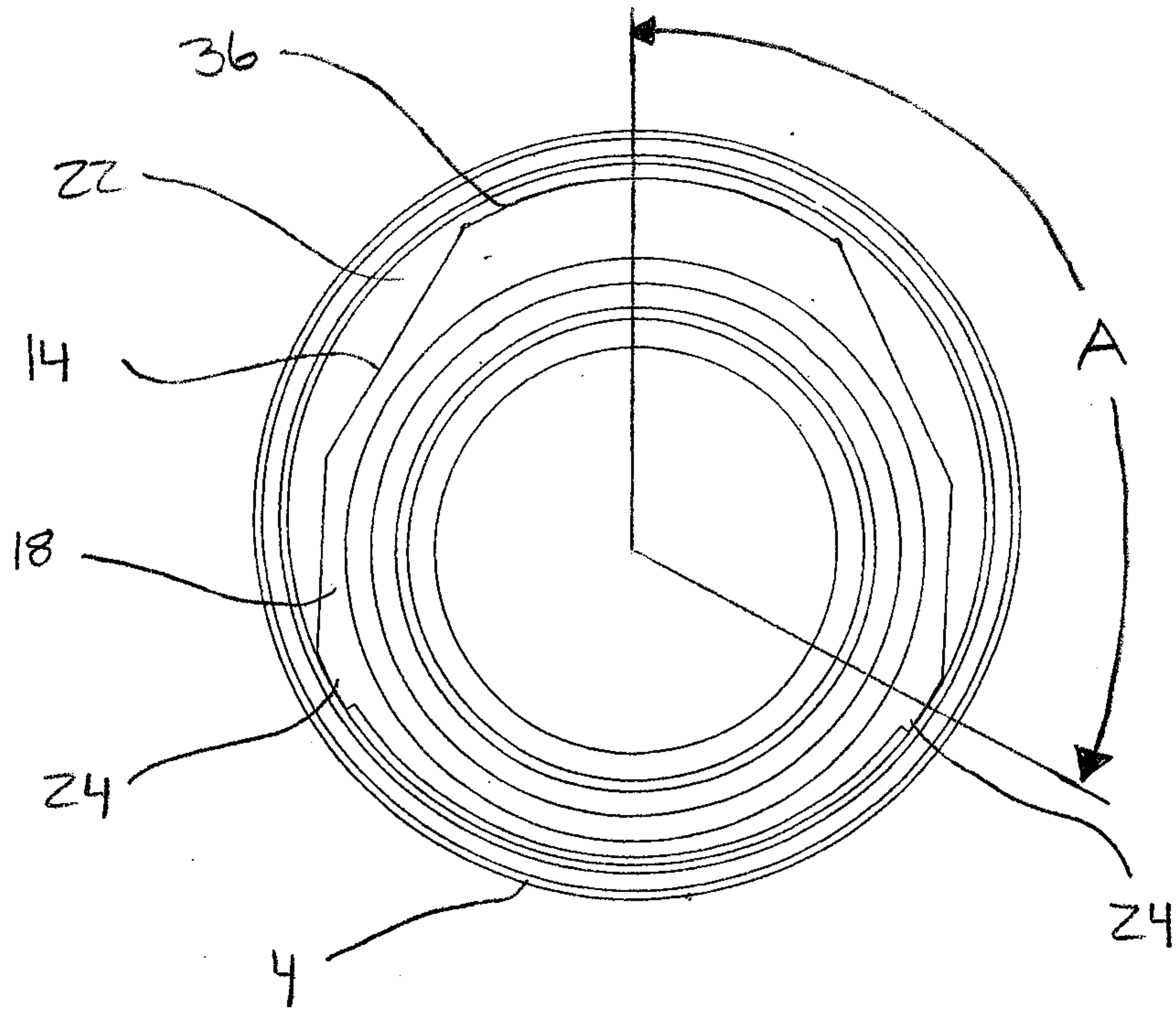


FIG. 3A

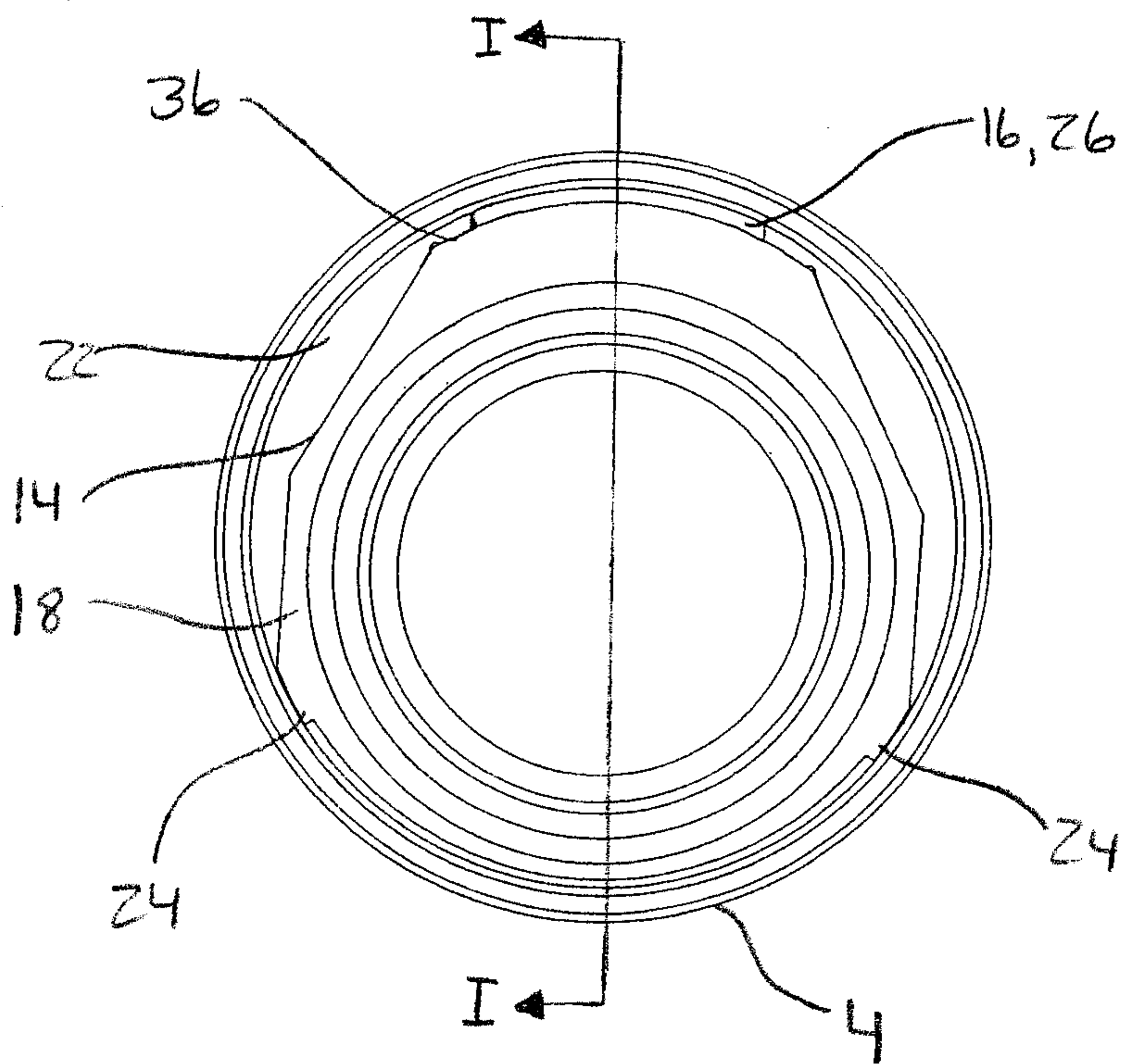


FIG. 3B

FIG. 4A

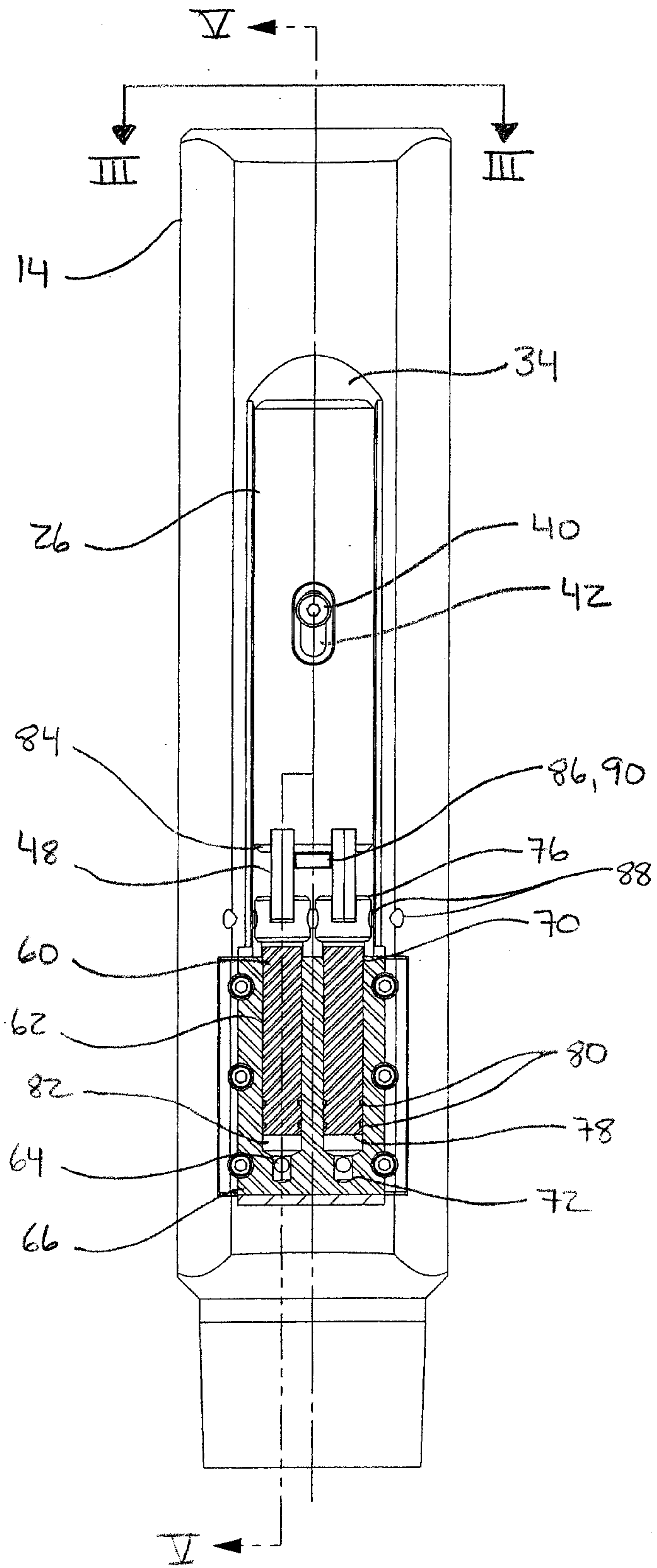
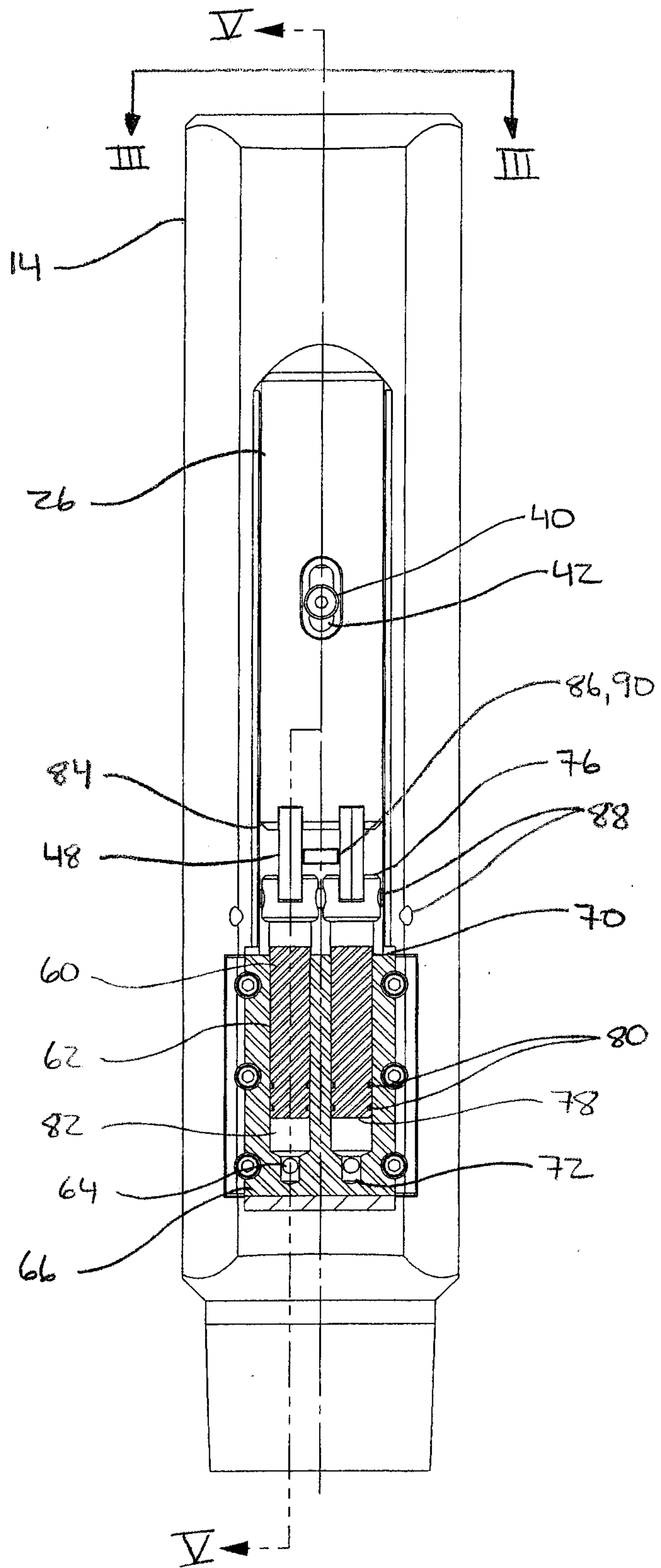
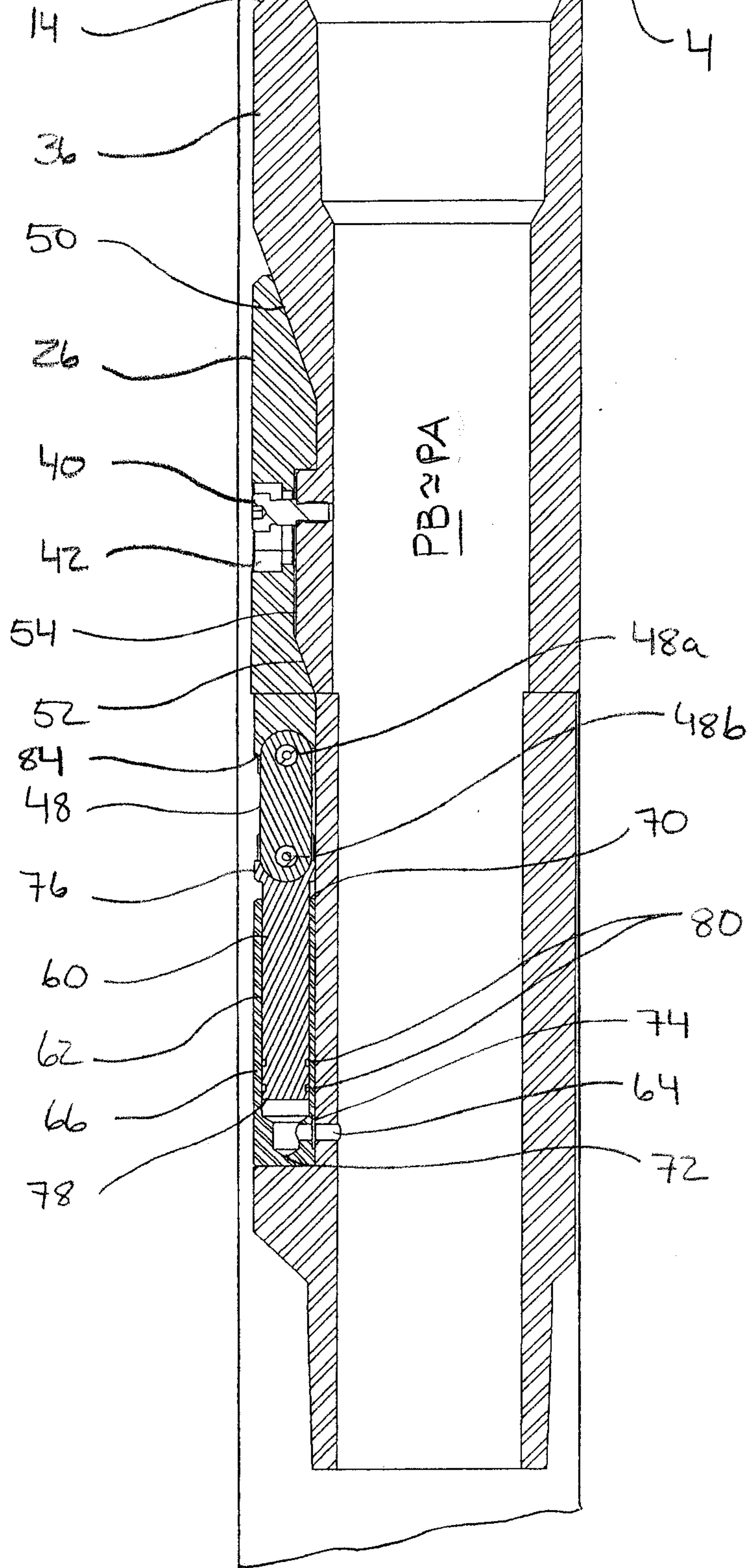


FIG. 4B



uphole  
↑

FIG. 5A



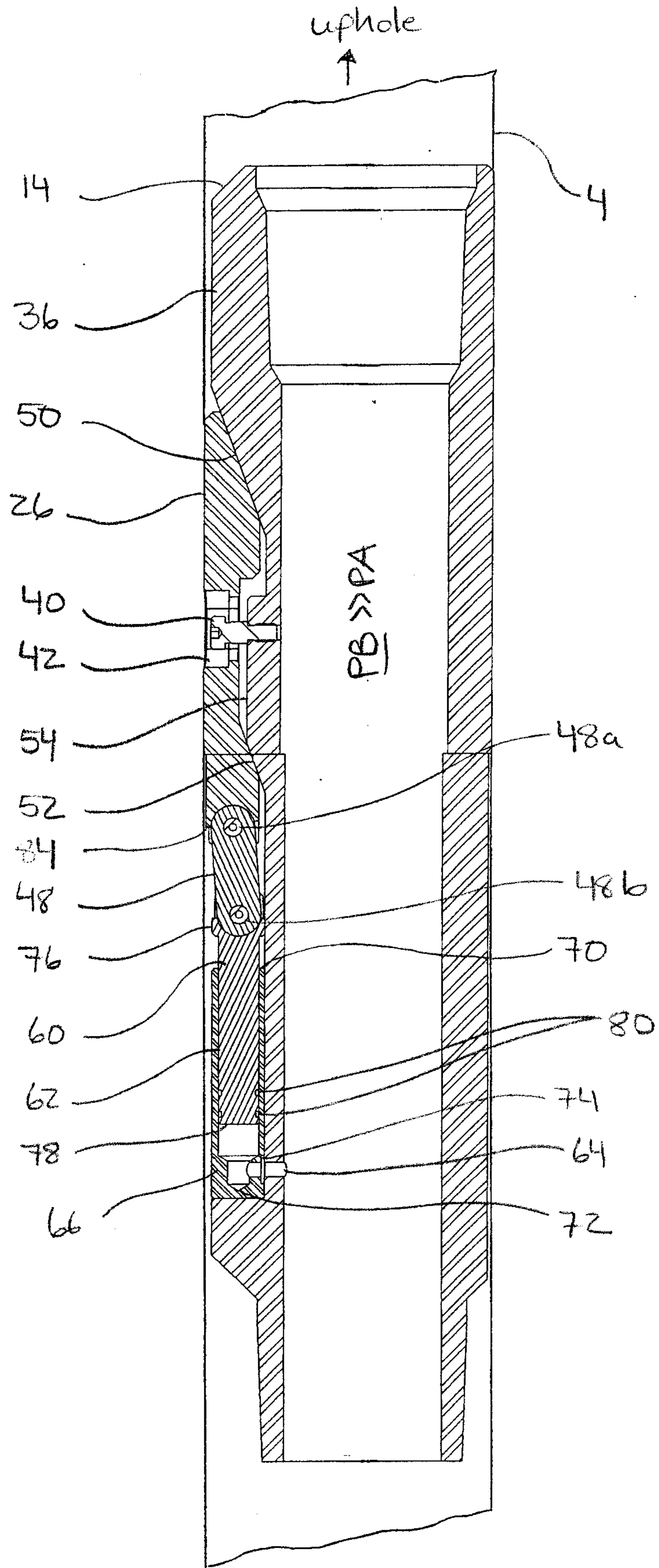


FIG. 5B

FIG. 6

